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Pai-Hung Pan

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EXAMINER

NGUYEN, CUONG QUANG

ART UNIT

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Please find below and/or attached an Office communication concerning this application or proceeding.



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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Paper No. 28

Application Number: 09/577,835
Filing Date: May 25, 2000
Appellant(s): PAN ET AL.

*Stephen A. Soffen & Christophers S. Chow**
For Appellant

EXAMINER'S ANSWER

MAILED
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GROUP 2800

This is in response to the appeal brief filed 11-17-03.

(1) *Real Party in Interest*

A statement identifying the real party in interest is contained in the brief.

(2) *Related Appeals and Interferences*

The brief does not contain a statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief. Therefore, it is presumed that there are none. The Board, however, may exercise its discretion to require an explicit statement as to the existence of any related appeals and interferences.

(3) *Status of Claims*

The statement of the status of the claims contained in the brief is correct.

(4) *Status of Amendments After Final*

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) *Summary of Invention*

The summary of invention contained in the brief is correct.

(6) *Issues*

The appellant's statement of the issues in the brief is correct.

(7) *Grouping of Claims*

The rejection of claims 25-30 stand or fall together.

(8) *Claims Appealed*

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) *Prior Art of Record*

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5,656,519	Mogami	8-1997
5,861,340	Bai et al.	01-1999

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 25-27 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 5,899,721) in view of Mogami (US 5,656,519).

Regarding claims 25-27, Gardner et al. discloses an integrated circuit comprising: a semiconductor substrate (10) having a surface; a gate dielectric film (102) formed on the surface of the substrate; a gate electrode stack having continuously vertical sidewalls formed on the gate dielectric film, wherein the gate electrode stack including a polysilicon layer (104) on the gate dielectric layer and a refractory metal silicide layer (122) on the polysilicon layer; a plurality of composite spacers each extending continuously on the vertical sidewalls, wherein each of composite spacers comprises a nitride spacers (114) vertically stacked above an oxide spacer (116) at an intermediate point. See Gardner et al.'s Fig.9.

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Gardner et al. does not teach that the spacer structures extend from a bottom to over a top of the continuously vertical sidewalls.

Mogami discloses a gate structure comprising a spacer structure (9) formed extending from a bottom to over a top of the continuously vertical sidewalls of a gate electrode stack. See Mogami's Fig. 8F.

It would have been obvious to one of ordinary skill in the art to form the spacer structure extending from a bottom to over a top of the continuously vertical sidewalls of gate electrode stack as taught by Mogami into Gardner et al.'s device in order to prevent the short circuit between the source/drain regions and gate electrode stack. See Mogami's col. 8 lines 5-15.

Regarding claim 30, Gardner et al. does not teach that the spacers have a thickness of 50-500 angstroms. However, the thickness of spacer is an art recognized variable of importance which is subject to routine experimentation and optimization. Therefore, it would have been obvious to one of ordinary skill in the art to arrive the spacer having the thickness as claimed.

Claims 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. in view of Mogami and further in view of Bai et al. (US 5,861,340).

Regarding claim 28, Gardner et al. and Mogami substantially teach all the limitations of claims 25-27 as shown above but does not teach that the silicide layer is a refractory metal silicide layer and a diffusion barrier layer formed between the polysilicon layer and the silicide layer.

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Bai et al. discloses a semiconductor device comprising: a gate stack (222) including a polysilicon layer (204), a conductive diffusion barrier layer (206, a TiN layer) on the polysilicon layer and a refractory metal silicide layer such as cobalt silicide, titanium silicide and platinum silicide. See Bai et al.'s Fig.2C and col.4 lines 16-41.

It would have been obvious to one of ordinary skill in the art to incorporate a conductive diffusion barrier layer between the polysilicon layer and the silicide layer as taught by Bai et al. into the device formed by the combination of Gardner et al. and Mogami because the conductive barrier layer would prevent diffusion of silicon atoms in the polysilicon layer into the silicide layer. See Bai et al.'s col.3 lines 14-18.

Regarding claim 29, the device formed by the combination of Gardner et al., Mogami and Bai et al. has the diffusion barrier layer of TiN which is the same material for forming barrier of present invention. Therefore, the barrier layer of combined device inherently has the same characteristics as claimed device such as the barrier is substantially impermeable to metal atoms.

(11) Response to Argument

Appellants argue that there is no motivation to combine Mogami and Gardner et al. references. In response, in Mogami the spacer structure extends above the top surface of the gate stack, therefore the silicide material (on top of the gate conducting layer) cannot bridge between the gate stack and source/drain region, so the short circuit between the gate stack and source/drain region can be prevented (Mogami's col.8 lines 5-15). Therefore, one of ordinary skill in the art would be motivated to incorporate the spacer structure of Mogami into Gardner et al.'s device.

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Appellants argue that the device being formed by Gardner et al. and Mogami would include oxide spacers not the composite spacers as claimed, because the spacers in Mogami are formed of oxide and even if the references were combined, the resulting structure would not correspond to the claimed invention. In response, Gardner et al. already teaches the composite spacer comprises a nitride spacer (114) vertically stacked above an oxide spacer (116) at an intermediate point. Mogami is relied upon merely to show the shape of the spacer which extends above the surface of the gate. In response to Appellant's argument that "Mogami does not teach composite spacer", the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). As shown in Fig.5 of the present disclosure, the composite spacer includes oxide layer (20) extending from the bottom most portion of the continuously vertical sidewall (18) to the intermediate point between the bottom most portion of the sidewall (18) and the top point of the sidewall spacer at the top surface of layer (15) (it is noted that the oxide cap (20) does not belong to the gate stack (10)) and the nitride layer (22) extends from the intermediate point to the top of the sidewalls (18). The device that would have been obvious from the combination of Gardner et al. and Mogami is one that has a composite spacer identical to the one, i.e. that includes the oxide layer (116) extending from the bottom most portion of the continuously vertical sidewall to the intermediate point

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between the bottom most portion of the sidewall (the bottom surface of gate oxide layer 102) and below the top point of the sidewall spacer, and the nitride layer (114) extends from the intermediate point to the top of the sidewalls (over the top surface of silicide layer 122 as taught by Mogami).

For above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Cuong Nguyen

Primary examiner

3/2/04

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